IN THE UNITED STATES DISTRICT COURT FOR THE

NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his)
capacity as ATTORNEY GENERAL)
OF THE STATE OF OKLAHOMA and)
OKLAHOMA SECRETARY OF THE)
ENVIRONMENT C. MILES TOLBERT,)
in his capacity as the)
TRUSTEE FOR NATURAL RESOURCES)
FOR THE STATE OF OKLAHOMA,)

Plaintiff,)

vs.) 4:05-cv-00329-TcK-SAJ

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DEPOSITION OF GLENN JOHNSON, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 24th day of February, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

TYSON FOODS, INC., et al,

Defendants.

TULSA FREELANCE REPORTERS 918-587-2878

1 2 3 4 5 6 7 8 9	this system, which is the degree to which well, first of all, total concentration and second, the degree with which how chemicals redistribute themselves in the environment according to their affinity for being bound to particulates or being in a dissolved phase. Q This is your muddy, salty water? A Yeah, it's the shorthand that I used within	1 2 3 4 5 6	A No. Again, to the extent that I call on a
2 3 4 5 6 7 8 9	well, first of all, total concentration and second, the degree with which how chemicals redistribute themselves in the environment according to their affinity for being bound to particulates or being in a dissolved phase. Q This is your muddy, salty water?	2 3 4 5 6	non-PCA opinions in Dr. Olsen's report? MR. GEORGE: Object to form. A No. Again, to the extent that I call on a
12 13	the report, but, yes. Q Anything else; any other key opinions? A I think these are the six that I pulled out because I thought they were the key six, so Q Fair enough, and, again, I'm not trying to limit you.		How about sources of bacteria, same question? A No. Q Are you offering any opinions to critique any
15 16 17 18 19 20 21 22 23	A Right. 11:08AM	15 16 17 18 19 20 21 22 23	A No. 11:11AM Q Which of the State experts' reports have you reviewed? A I reviewed Fisher's report, obviously nowhere in the detail I looked at Dr. Olsen's report. I'm trying to think if there are others. I believe 11:11AM there's either a letter I don't know if it's an expert report, but a letter from Harwood is an appendix in Dr. Olsen's report, which I have seen
	by way of making maps. So in that respect, yes. 11:09AM	25	
	Page 79		Page 81
1 2 3 4 5 6 7 8 9	Q That was the report the samples and analyses collected by the State of Oklahoma in this case? A No. This would have been data oh, yes. To the extent that the data produced by Dr. Olsen falls in that category, yes. Q Okay. I wasn't clear. What I'm asking you, did you perform any of your field investigations in this case?	1 2 3 4 5 6 7 8 9	think of. Q Okay, and are you offering any opinions concerning Dr. Fisher's report? A No, not specifically. I believe the poultry house density map, which I used as a base layer, if I read Dr. Olsen's report correctly, was actually work that was done by Fisher. So I guess secondarily, yes. Q We'll get to that in a little while. Did you
10	A Oh, no. 11:09AM Q Why not?	10 11	review Dr. Engel's report? 11:12AM A I don't believe I did.
12 13 14 15 16 17 18 19	A I was asked to look at the PCA that Dr. Olsen did based on the existing data. Q Okay. So is it fair for me to understand that your primary role is to critique the opinion of Dr. 11:09AM Olsen on his PCA analysis? A To understand what he did and evaluate the degree to which it did or did not support his opinions and conclusions.	12 13 14 15 16 17 18 19	Q Do you know that Dr. Engel did a modeling analysis in this case to identify sources? MR. GEORGE: Object to form. Answer, if you can. 11:12AM A I knew there was modeling being done on the plaintiff's side. I wasn't sure if I could have told you it was Engel that did it. Q Okay. Did you review Dr. Teaf's report?
20	Q For the PCA analysis? 11:10AM A For the PCA analysis. Q Did you evaluate any of the other opinions in Dr. Olsen's report? A Peripherally but in the context of the degree to which it informed on the PCA. 11:10AM	20 21 22 23 24 25	A No, I have not. 11:13AM Q Did you review any information involving the what I would call an analysis of the amount of bacteria that is in waste streams within the Illinois River watershed? A Not that I recall. 11:13AM

21 (Pages 78 to 81)

Page 86 1 A Yes 2 Q — was that a source identification project? 3 A Again, that was the objective. 4 Q Were you aske to the content of the patterns we saw were related to 7 source. I'm pretty sure some of the patterns we saw were related to 8 occurred process. 9 Q Okay. Did you use a multivariate analysis on 10 that case? 11 20 AM 7 Ses, we did. 12 Q Anything else, can you think of any of other 13 projects where you focused on inorganic constituents in 14 your source of contamination analysis? 15 A When you asked the question a couple of times 14 in your source of contamination analysis? 16 ago, you — at that pointly you started limiting it to 18 PhD and not — there was similar to the 19 primarily related to organic even more so. 20 A There was another —there was similar to the 18 Stan Rigas, Albemarfe one. There may be others. 21 Tele glad — if you want to spend the time, I can 3 go back through my CV, but if su pt o you. I may be a she to add a couple to the list if you want. 22 A Yes, poat PhD, that's — did you agar. 23 Q Yes. 34 A Yes. Chlorinated organic even more so. 35 Q Okay. Have you even worked on — I'm going to mean an investigation, a 7 source investigation — involving agricultural 8 pollution other than this case? 35 MR. ELROD. Object to form. 36 pollution other than this case? 37 MR. ELROD. Object to form. 38 pollution other than this case? 39 MR. ELROD. Object to form. 31 Q How about same question with regard to 11:22AM 31 A Not that I recall. 31 Q Orany other animal waste pollution? 32 A Not that I recall. 34 A not down integer that which the sewages shudge, and so the answer to that would be the only instance? 39 A There was another open on the same survey. 30 A Not that I recall. 31 A The with a would be the only instance? 31 A That the only unstance? 32 A There you been involved in a source involved in a source involved in a source involved in storace and include the same and involving agricultural and the survey of the second such as this, but within my CV in the second such as this, but wi	Г		:	Volume 1, 2-24-09
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20 A No. 11:22AM 20 A We on the first day or first part of that 11:25AM	19			
01.0				
, ——, mile in out the outer deferred formation	21	:		· •
22 answer would be no, that you've never worked on a 22 by the defendants whose names I don't recall. We	22	· · · · · · · · · · · · · · · · · · ·		
23 case involving poultry waste? 23 were given a tour of the watershed by air, flying		· · · · · · · · · · · · · · · · · · ·		
MR. GEORGE: Object to form. 24 out of Siloam Springs. I don't recall the exact				
25 A No Thomas de Caract		· :		

23 (Pages 86 to 89)

	Page 134			Do mo 126
,	·			Page 136
1 2	A Not that I recall. I mostly focused on the	1	are manuple officer sources	
3	PCA results to the extent that it's discussed in my	2	not considered by Olsen at all, spray irrigation,	
4	expert report. Q Did you do any evaluation of the chemical	3	sludge application, biosolids application, nursery	
5	constituents of cattle waste? 01:31PM	: 4	runoff, golf courses, wildlife, swine lagoons,	
6	A Again, that was part of the same two principal	5	septic systems, runoff from dirt roads and commercial fertilizer application.	01:34PM
7	component runs that included the poultry litter.	7	Q Did you consider the chemical compositions of	
8	Q But you didn't look at the analytical results	8	any of those sources in your analysis?	
9	on the cattle waste itself?	9	A I did not. I was not asked to do that. I was	
10	MR. GEORGE: Object to form. 01:31PM	10		
11	A I believe that I probably looked at the	11	01.51111	
12	spreadsheets that contained that data. I did not	12	A Okay.	
13	spend much time reanalyzing that data as I did with	13	•	
14	the principal components analyses.	14		
15	Q Did you find that there's a different chemical 01:32PM	15	A All right. 01:34PM	
16	composition between poultry and cattle waste?	16	•	
17	MR. GEORGE: Object to form.	17		
18	A To the extent it's reflected on that PCA	18	ask another question. Did you do any evaluation of	
19	graph, yes. They plot in different locations on the	19		
20	PCA graph, which indicates that at least for the 01:32PM	20	of the sources you just read from in your report?	01:34PM
	chemicals that are accurately back calculated in	21	,	
	that PCA, they have different chemical compositions.	22	,, jen ale	
23	Q Did you do any evaluation of the chemical	23	The state of the s	
1	constituents in human waste?	24	, and a second s	
25	A No. I don't know that I've seen data that 01:32PM	25	amount of waste generated from those sources. How	01:35PM
	Page 135			Page 137
1	that that shows that and, again, that was nor	1	can you then be critical of Dr. Olsen for not	
2	was it what I was asked to evaluate.	2	considering those sources?	
3	Q Did you do any evaluation, Dr. Johnson, about	3	MS. COLLINS: Object to the form.	
4	the amount of waste produced by poultry production	4	A Well, for one, these things that I'm telling	
5	within the IRW? 01:33PM	5	you I was not asked to do, I believe he was. He was	01:35PM
6	MR. GEORGE: Object to form, asked and	6	asked to put together a PCA-based model that	
7	answered.	7	identified sources. Number two, when I redid the	
8	MR. PAGE: My earlier question had to do	8	PCA, I came to the conclusion, based on my	
9	with the amount of poultry, and this question has to	9	reanalysis, that that was driving the signal that	
10	do with the amount of poultry waste. 01:33PM	10	was driving the two principal component model that	01:35PM
11	MR. GEORGE: Same objection.	11	he presented was related to the basic geochemical	
12	A Again, no and, again, I was not asked to.	12	affinity of the analytes, specifically potassium,	
13	Q What about cattle waste; did you do an	13	chloride, sodium, sulfate, iron and aluminum, and so	
14	evaluation about the amount of cattle waste produced	14	the PCA story is not a story related to source, as	
15	in the IRW? 01:33PM	15	much as it is a story related to chemical affinity.	01:36PM
16	A Same answer.	16	Q How can you know whether or not these sources	
17	Q Swine?	17	you listed would be important for consideration if	
18	A Same answer.	18	you don't know either its chemical composition or	
19	Q Human waste?	19	the amount of that source that's generated within	
20	A Same answer. 01:33PM	20	the IRW? 01:36PM	
21	Q Would you turn to Page 4 of your report, sir?	21	A Because regardless of their chemical	
22	Under 1.3, opinions	22	composition, it's the affinity of the chemicals once	
23	A Uh-huh.	23	they start partitioning in the environment that is	
24	Q would you read the last sentence of that		driving this chemical system that is being analyzed	
25	paragraph, please, under the first bullet? 01:34PM	25	here. 01:36PM	

35 (Pages 134 to 137)

	Page 14	2		Page 144
1	A Except to the extent to compare the PCA	1	A Yes. After I've in my report on Page 62,	
2	results to the source characterization that Dr.	2	after I've made the point that the bottom sample	
3	Olsen indicated supported his conclusions.	3	trend of Olsen's SW3 scores plot is driven primarily	
4	Q Do you know what the sources of phosphorus are	4	by the concentration of total iron plus total	
5	in the IRW? 01:42PM	5	aluminum, I point out that iron and aluminum are	01:45PM
6	A No, I don't.	6	generally associated with sediment fraction of	
7	Q Do you know what the sources of bacteria,	7	natural waters, and adsorption of phosphorus to	
8	fecal bacteria are in the IRW?	8	suspended particulate matter is common, and that	
9	A No, I don't.	9	phosphate ions taken up from water in alumina clay	
10	Q Do you know whether or not poultry litter 01:42PM	10	particles are taken up by water I'm sorry	01:45PM
11	that's land applied is incorporated into the soil or	11	taken up from water by alumina clay particles and	
12	not?	12	freshly precipitated iron aluminum hydroxides, and I	
13	A I don't know if it's just laid down or whether	13	cite a source for that, and then the next sentence,	
14	it's tilled into the soil somehow. In terms of how	14	as such, particle-bound phosphorus constitutes much	
15	it's applied, I don't know technically how that's 01:42PM	15	1 1	01: 46PM
16	accomplished.	16	respectively	
17	Q Do you know how long poultry waste has been	17	paper he identify he identifies some of these	
18	applied in the IRW?	18	cultivated land sources of phosphorus.	
19	A No.	19	Q So it's your opinion that most of the	
20	Q Are you aware of any pasture, hay field in the 01:43PM	20	i i i i i i i i i i i i i i i i i i i	01:46PM
21 22	pourty waste.	21	where poultry waste has been applied is in the	
23	MR. GEORGE: Object to form.	22	particulate form?	
24	1 1 7 7 8	23	MR. GEORGE: Object to form.	
	was not pasture. Was that your question, pasture or what was the second part? 01:43PM	24	1 1	01.4673.5
	what was the second part? 01:43PM	25	we measure in the water is bound to particulates.	01:46PM
	Page 14	3		Page 145
1	Q Hay field.	1	Whether it is released from the source in the	
2	A The only samples I've seen from a cattle field	2	dissolved phase and later adsorbs onto a particle or	
3	in absence of poultry has been the Fite property,	3	a sediment grain, I'm not saying that I know if it	
4	which my understanding was rodeo stock. So the	4	was originally released as a particulate-bound	
5	answer to your question would be no. 01:43PM	5	phosphorus. 01:47PM	
6	Q Did you do any evaluation of sources for	6	Q So it's possible that the phosphorus that's	
7	phosphorus in the IRW at all, review any literature,	7	released from a poultry-applied field could have	
8	for example?	8	been in its dissolved phase prior to it reaching the	
9	A There's literature cited in my report. Was	9	ambient stream water?	
10	your question specific to IRW? I'm sorry? 01:44PM	10	A I can't discount that. 01:47PN	1
11	Q Yes, yes. Sources of phosphorus in the IRW.	11	Q Do you know how many fields are cultivated	
12 13	A No. Did you do any evaluation of sources of	12	fields in the IRW?	
	Q Did you do any evaluation of sources of	13	A No, I don't know that number.	
14 15	phosphorus in ambient water, surface waters of the IRW? 01:44PM	14	Q Isn't it true that there's very few row crop	
16		15	in the IRW? 01:47PM	
17	A Again, this is a question I thought you asked	16	MR. GEORGE: Object to form.	
18	at first, but one of the papers I cited in my report is Sharpley and Smith, and he addresses he	17	A Since I don't know the number, I don't know if	
19	addresses phosphorus in surface water sources	18	that's true or false.	
20	phosphorus sources in surface water. Excuse me. 01:44PM	19	Q Whether if the IRW has very few row crops,	01.47D3.5
20	Q And why did you review that?	20	would your reliance on Mr. Sharpley's paper be	01:47PM
21		21	somewhat doubtful?	
21 22	A If memory serves well let's not go from			
22	A If memory serves well, let's not go from	22	MR. GEORGE: Object to form.	
	A If memory serves well, let's not go from memory. If I could turn to my report Q Certainly. Can you tell me where you're	23 24	A I'm not sure the extent that the statement that Sharpley and Smith make about particle-bound	

37 (Pages 142 to 145)

	Page 146		Page 14
1	•	1	•
2	is dependent on row crops. Q Why would you say that? If you haven't	1 2	A Because what the PCA is showing is the
3		:	basic is the affinity of phosphorus, iron and
4	cultivated a field, if you're applying poultry waste to a non-cultivated field, isn't there less	3	aluminum, which means the affinity of total
5			phosphorus to particles regardless of where they
6	opportunity for particle affinity? 01:48PM MR. GEORGE: Object to form.	5	come from. 01:51PM
7	A I'm having trouble understanding the question.	7	Q So how does that help you understand whether
8	You're saying	8	or not the source of phosphorus a source of
9	Q Well, your statement here I'm sorry,	9	phosphorus in the IRW is from land-applied poultry waste?
10	Doctor, if I'm being unclear, but I'm doing my best. 01:49PM	10	
11	You state here, as such I'm reading from your	11	,,
12	report, Page 62 particle-bound phosphorus	12	this and I wanted to look at find out what the
13	constitutes much of the phosphorus from runoff from	13	•
14	cultivated land.	1	1 1 ,,
15	A Right. 01:49PM	14	identify each individual sample and do what you're
16		15	suggesting to do, but that doesn't that doesn't 01:51PM
17	Q Cultivated land, that would be land that would be tilled; correct?	16 17	1 1
1	•	•	prefers tends to be associated with the
18 19	MR. GEORGE: Object to form.	18	particulate phase. I don't need to take that I
· [A Yeah, but at the same time I'm not saying that	19	• •
20	cultivated land is the only source of particle-bound 01:49PM	20	conclusion that total phosphorus tends to be 01:52PM
21	phosphorus. The point this is a sentence within	21	associated with the with sediments.
22	within an overall paragraph that's talking about	22	Q But doesn't that tend to help you understand
23	the preferential affinity of total phosphorus to be	23	, , , , , , , , , , , , , , , , , , ,
24	in the particle-bound phase. Now, this sentence	24	was a source from a poultry land application as
25	supports that, that it's particle bound in 01:49PM	25	opposed to another source? 01:52PM
	Page 147		Page 14
1	cultivated lands, but that doesn't mean that that	1	MR. GEORGE: Object to form.
2	affinity of total phosphorus to be bound to	2	A Perhaps if I had been asked to take to make
3	particulate matter is different if the particulate	3	that to take this a few extra steps to that
4	is coming from some source other than cultivated	4	point, then perhaps yes, perhaps no. It's difficult
5	land. 01:49PM	5	to comment on an analysis that I didn't do and what 01:52PM
6			
	Q Okay.	6	•
7	Q Okay. A Whether it's somebody's boot kicking up a	6 7	value it might or might not have.
7 8	A Whether it's somebody's boot kicking up a	:	value it might or might not have. Q Other than this Sharpley article, did you do
1	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever.	7	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus
8	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the	7 8 9	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW?
8 9	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where 01:50PM	7 8 9 10	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM
8 9 10 11	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where poultry waste has been applied?	7 8 9 10 11	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW?
8 9 10	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where poultry waste has been applied? MR. GEORGE: Object to form.	7 8 9 10 11 12	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No.
8 9 10 11 12	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the	7 8 9 10 11 12 13	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus
8 9 10 11 12 13 14	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the question have I done	7 8 9 10 11 12 13 14	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus wastewater treatment, for example.
8 9 10 11 12 13 14 15	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the question have I done Q Any analysis. 01:50PM	7 8 9 10 11 12 13 14 15	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus wastewater treatment, for example. A Okay. No. 01:53PM
8 9 10 11 12 13 14 15	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where 01:50PM poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the question have I done Q Any analysis. 01:50PM A Analysis of runoff from did you say	7 8 9 10 11 12 13 14 15 16	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus wastewater treatment, for example. A Okay. No. 01:53PM Q I'm trying to understand, Doctor. Wouldn't
8 9 10 11 12 13 14 15 16	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where 01:50PM poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the question have I done Q Any analysis. 01:50PM A Analysis of runoff from did you say cultivated or non-cultivated land or	7 8 9 10 11 12 13 14 15 16	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus wastewater treatment, for example. A Okay. No. 01:53PM Q I'm trying to understand, Doctor. Wouldn't that information be helpful for you in determining
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8 9 10 11 12 13 14 15 16 17 18 19	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where 01:50PM poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the question have I done Q Any analysis. 01:50PM A Analysis of runoff from did you say cultivated or non-cultivated land or Q Poultry-applied lands in the IRW. A Okay. No, not specifically.	7 8 9 10 11 12 13 14 15 16 17 18	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus wastewater treatment, for example. A Okay. No. 01:53PM Q I'm trying to understand, Doctor. Wouldn't that information be helpful for you in determining whether or not this is a source-driven versus a process-driven system?
8 9 10 11 12 13 14 15 16 17 18 19 20	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where 01:50PM poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the question have I done Q Any analysis. 01:50PM A Analysis of runoff from did you say cultivated or non-cultivated land or Q Poultry-applied lands in the IRW. A Okay. No, not specifically. Q Would an analysis of those, the chemical 01:50PM	7 8 9 10 11 12 13 14 15 16 17 18 19 20	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus wastewater treatment, for example. A Okay. No. 01:53PM Q I'm trying to understand, Doctor. Wouldn't that information be helpful for you in determining whether or not this is a source-driven versus a process-driven system? MR. GEORGE: Object to form. 01:53PM
8 9 10 11 12 13 14 15 16 17 18 19 20 21	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the question have I done Q Any analysis. O1:50PM A Analysis of runoff from did you say cultivated or non-cultivated land or Q Poultry-applied lands in the IRW. A Okay. No, not specifically. Q Would an analysis of those, the chemical 01:50PM contribution of that runoff be important to your PCA	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus wastewater treatment, for example. A Okay. No. 01:53PM Q I'm trying to understand, Doctor. Wouldn't that information be helpful for you in determining whether or not this is a source-driven versus a process-driven system? MR. GEORGE: Object to form. 01:53PM A No.
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8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever. Q Did you have you done any evaluation of the constituents that run off of land in the IRW where poultry waste has been applied? MR. GEORGE: Object to form. A No. I've not been asked to do was the question have I done Q Any analysis. 01:50PM A Analysis of runoff from did you say cultivated or non-cultivated land or Q Poultry-applied lands in the IRW. A Okay. No, not specifically. Q Would an analysis of those, the chemical 01:50PM contribution of that runoff be important to your PCA critique?	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21	value it might or might not have. Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW? A Specific sources? 01:53PM Q Yes. A No. Q As, you know, poultry, cattle versus wastewater treatment, for example. A Okay. No. 01:53PM Q I'm trying to understand, Doctor. Wouldn't that information be helpful for you in determining whether or not this is a source-driven versus a process-driven system? MR. GEORGE: Object to form. 01:53PM A No. MR. GEORGE: Asked and answered.

38 (Pages 146 to 149)

		Page 150			Page 152
1	trends on the first two principal components are	1 age 100	1	treatment plant effluent samples and see where they	1 uyc 132
2	driven by iron and aluminum, which is a surrogate		2	were.	
3	for particulates on one trend and sodium, potassium	1	3	Q So if there was high phosphorus levels in the	
4	the more soluble analytes, on the other trend. So	1,	4	effluent from wastewater treatment plants, would	
5	it's an explanation that is much simpler. It's an	01:54PM	5	that tend to negate your hypothesis that this is a	01:57PM
6	explanation that doesn't call for making exceptions	01.5-1111	6	process-driven system	01.571 IVI
7	to a 1.3 Principal Component 1 threshold or		7	MR. GEORGE: Object to form.	
8	apologizing for exceptions to the rule. It's very		8	Q for the phosphorus?	
9	consistent with very simple geochemistry, and so the	e	9	A Not at all. Once the phosphorus gets out into	
10	first order control on this system is geochemical		10	the stream, regardless of source, whether it's	01:57PM
11	process affinity to either sediment or in the	01.5 11 141	11	wastewater treatment plant or poultry litter or what	01.371141
12	dissolved phase. I'm not sure I answered your		12	have you, the geochemical processes of adsorption	
13	question, but I'm balking with		13	and solution are relevant regardless of what the	
14	Q I'm not sure you did either.		14	original source of phosphorus was.	
15	A I guess the original question, I don't need to	01:55PM	15	Q Do you know whether or not poultry waste is	01:57PM
16	go any farther than this to know that it's basic		16	typically applied within a few miles of where it is	021072212
17	geochemistry that's driving this system. I've		17	produced in the poultry houses?	
18	convinced myself of that and I hope I've convinced		18	MR. GEORGE: Object to form.	
19	the people that read this report.		19	A No, I don't know. I don't know how far it	
20	Q Well, let me ask you this: If there's not	01:55PM	20		:58PM
21	sufficient background quantities of phosphorus in		21	Q Do you know when poultry waste is most often	
22	the soils to account for the phosphorus that we're		22	land applied; what time of year?	
23	finding in the ambient waters of the IRW, to what		23	A I believe spring and summer is my	
24	would you attribute this phosphorus?		24	recollection.	
25	MR. GEORGE: Object to form.	01:55PM	25	Q Would you give me a definition of a watershed,	01:58PM
		Page 151			Page 153
1	A Well, the premise is there's not sufficient		1	please?	
2	background phosphorus, which you are representing to	0	2	A My understanding of a watershed is of an area	
3	me. I don't know if that's true or not.		3	that's all within a single drainage basin, draining	
4	Q Okay. Well, did you evaluate the reference or		4	to a single downstream point. I that's not a	
5	background levels of phosphorus in the IRW?	01:55PM	5	definition that I looked up in a book before I	
6	A No. That's why I say I don't know whether		6		01:59PM
7			: •	walked in here, but that's I think that's a	01:59PM
	what you are representing to me is true or not.		7	walked in here, but that's I think that's a reasonable expression of my understanding.	01:59PM
8	what you are representing to me is true or not. Q And you say that's not important to your		:	reasonable expression of my understanding.	01:59PM
8 9	· · · · · · · · · · · · · · · · · · ·		7	reasonable expression of my understanding.	01:59PM
	Q And you say that's not important to your evaluation?	01:56PM	7 8 9	reasonable expression of my understanding. Q Okay. So if you were trying to determine what	01:59PM 01:59PM
9	Q And you say that's not important to your evaluation? MR. GEORGE: Object to form.	01:56PM	7 8 9 10	reasonable expression of my understanding. Q Okay. So if you were trying to determine what land area or what waters contribute to a particular	
9 10	Q And you say that's not important to your evaluation? MR. GEORGE: Object to form.	01: 56PM	7 8 9 10	reasonable expression of my understanding. Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which	
9 10 11	Q And you say that's not important to your evaluation? MR. GEORGE: Object to form. A I'm saying that it doesn't change my opinion	01:56PM	7 8 9 10 11	reasonable expression of my understanding. Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which land areas drain into that area where the sampling	
9 10 11 12	Q And you say that's not important to your evaluation? MR. GEORGE: Object to form. A I'm saying that it doesn't change my opinion that this is a process-driven principal components	01:56PM	7 8 9 10 11 12	reasonable expression of my understanding. Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which land areas drain into that area where the sampling point is being taken?	
9 10 11 12 13 14	Q And you say that's not important to your evaluation? MR. GEORGE: Object to form. A I'm saying that it doesn't change my opinion that this is a process-driven principal components first and foremost.	01:56PM 01:56PM	7 8 9 10 11 12 13	reasonable expression of my understanding. Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which land areas drain into that area where the sampling point is being taken? A Yes. That's reasonable.	
9 10 11 12 13 14	Q And you say that's not important to your evaluation? MR. GEORGE: Object to form. A I'm saying that it doesn't change my opinion that this is a process-driven principal components first and foremost. Q Okay.		7 8 9 10 11 12 13 14	reasonable expression of my understanding. Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which land areas drain into that area where the sampling point is being taken? A Yes. That's reasonable. Q Do you know whether or not there's a GIS	01:59PM
9 10 11 12 13 14 15	Q And you say that's not important to your evaluation? MR. GEORGE: Object to form. A I'm saying that it doesn't change my opinion that this is a process-driven principal components first and foremost. Q Okay. A Phosphorus, regardless of source or regardless		7 8 9 10 11 12 13 14 15	reasonable expression of my understanding. Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which land areas drain into that area where the sampling point is being taken? A Yes. That's reasonable. Q Do you know whether or not there's a GIS program that allows one to readily identify a	01:59PM
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9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	Q And you say that's not important to your evaluation? MR. GEORGE: Object to form. A I'm saying that it doesn't change my opinion that this is a process-driven principal components first and foremost. Q Okay. A Phosphorus, regardless of source or regardless whether, as you suggested perhaps, some background level, total phosphorus will — has an affinity for the particulate phase, and that's what we're see — that's what is driving this analysis. Q Have you — did you look and see whether or not there's any phosphorus that's being — or what are the levels of phosphorus that are coming out of wastewater treatment plant effluent?	01:56PM	7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	reasonable expression of my understanding. Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which land areas drain into that area where the sampling point is being taken? A Yes. That's reasonable. Q Do you know whether or not there's a GIS program that allows one to readily identify a subwatershed to determine what area drains into a particular sampling location? A Wouldn't surprise me if there was one, but I couldn't give you the name of such a software program. Q Have you ever done that yourself? A No.	01:59PM

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	Da wa 177	-	
	Page 174		Page 1
1	not accurately reproduce the concentrations of	1	fields, whether it's dissolved or total or
2	arsenic, copper or zinc, so the degree to which	2	particulate P?
3	these are tracers for poultry litter is irrelevant	3	MR. GEORGE: Object to form, asked and
4	to the PCA with only two principal components.	4	answered.
5	Q Okay. Can you go down to the bottom sentence 02:44PM	5	A No. 02:47PM
6	of that paragraph where it starts we found, would	6	Q If there was particulates in poultry waste,
7	you read that, please?	7	wouldn't that prevent the loss that's in poultry
8	A Oh, it's not marked in highlighter? Is this	8	waste and on land-applied fields for running off in
9	the last sentence?	9	a dissolved phase?
10	Q It says we found copper and zinc	10	MR. GEORGE: Object to form. 02:47PM
11	concentrations.	11	
12	A We found copper and zinc concentrations in	12	Could you please reread that, please?
13	runoff water as high as 0.7 and 0.1 milligrams per	13	COURT REPORTER: And I think I
14	litter, indicating a potential problem.	14	misunderstood it as well.
15	Q Okay. Would you agree or disagree with that 02:45PM	15	(Whereupon, the court reporter read
	statement?	7	back the previous question.)
17	MR. GEORGE: Object to form.	17	Q Wouldn't that prohibit?
	A I have no reason to disagree with it.	18	A I don't know the extent to which that would
	Q Would you go to the bottom of that column and	19	prohibit it or not. I don't know. That's not my
20	the paragraph that begins the majority; would you 02:45PM	20	area of expertise. 02:48PM
	read that, please?	21	Q In your process analysis in order to confirm
	A Although it is uncertain if metal runoff is a		
23	major problem with the use of animal manures, high P	22	your analysis of the PCA, wouldn't it be important
24		23	to have an understanding of what materials are
	concentrations have been documented in runoff water	24	running off from poultry waste in a dissolved versus
	from pastures fertilized with low to moderate 02:45PM	25	a particulate phase and whether or not there's 02:48P
	Page 175		Page 1
1	amounts of poultry manure, causing concerns over the	1	particulates in the environment to which the
2	utilization of this valuable resource in areas of	2	dissolved phase constituents could attach?
3	the USA where poultry production is high, and then	3	MR. GEORGE: Object to form.
4	two citations.	4	A I'm not sure if it would or wouldn't because
5	Q Continue. 02:46PM	5	my understanding is they can partition between 02:48PM
6	A Phosphorus is normally the limiting element	6	phases once they get into the ambient environment.
7	for eutrophication in freshwater bodies, such as	7	Q But if there isn't any particulate to
8	rivers, lakes and reservoirs. Should I continue on	8	partition to, wouldn't that affect your analysis?
9	to the next page?	9	
10		:	MR. GEORGE: Object to form.
	Q Yes. 02:46PM	:	A Again, you're representing there are no 02:48PM
11	• • • •	:	particulates in the stream water and if that is
	runoff from fields fertilized with poultry litter is	12	true, then I suppose that's something to consider.
13	dissolved P, which is the form most readily	13	I don't I doubt the streams here are void of
14	available to algae.	14	particulate matter.
15	Q Would you agree or disagree with the last 02:46PM	:	Q Wouldn't the relative availability of 02:49PM
16	statement you read there that says the majority, 80	16	particulates in relationship to the amount of
17	to 90 percent, of P in runoff water from fields	17	dissolved constituents or running off of poultry
18	fertilized with poultry litter is dissolved P, which	18	land-applied fields have an important place in your
19	is the form most readily available to algae?	19	evaluation?
20	MR. GEORGE: Object to form. 02:46PM	20	MR. GEORGE: Object to form. 02:49PM
21	A I don't know. I don't I have no reason to	21	A I don't know if I would characterize it as
22	disagree with these guys.	22	important or not.
23	Q Do you have any understanding of what the	23	Q Can we look to Page 94, sir, of the same
24	did you do any study of what the most common form of	24	· ·
	P is that is running off from poultry-litter applied 02:46PM	25	

45 (Pages 174 to 177)

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		Page 182		Page 1
		tamination?	1	to these conclusions. Olsen justifies his
3	A:11	It can be, but there's no guarantee that it	2	interpretation with a poorly reasoned
4	will		3	apples-to-oranges comparison of loadings presented
5	Q the	Okay. So you recognize it has been used in past to identify sources? 02:56PM	4	in abstract units of the PCA, log-transformed
6	A	past to identify sources? 02:56PM Yes, it has.	5	correlation coefficients to chemical data and units 02:59PM
7	Q	Okay. Do you believe it could be effective in	: 6	of concentration.
8	-	ntifying sources in the IRW?	8	Q Could you explain for us what you mean by that statement?
9	A	I state this in my report. I don't believe it	9	
10		Ild be unless especially if you're interested 02:56PM	10	and the second of the second o
11		shosphorus in bacteria, I don't think it's	11	we just looked at them. You had me turn to that 02:59PM page. It has been plotted do you recall the page
12		sible without going back and getting a consistent	12	
13		complete data.	13	
14	Q	I think I've covered this. I want to make	14	,,,
15	-	e. Do you know how many different sources of 02:56PM	15	indicated, is a function of the correlation 02:59PM
16		rients there are in the IRW?	16	
17		MR. GEORGE: Object to form, asked and	17	these individual analytes. So the units there are
18	ansv	wered.	18	units of a correlation coefficient, which vary from
19	Q	Sources in water in contamination?	19	zero to one, so essentially unitness. The chemical
20	Α	Sources of 02:56PM	20	compositions that he was comparing these bar graphs 02:59P.
21	Q	Nutrients.	21	to was a table let me back up to the text that
22	Α	No, I don't.	22	precedes that paragraph. So he's comparing to
23	Q	How about for metals?	23	presume poultry waste impacted water, and I think by
24		MR. GEORGE: Same objection.	24	that, he was looking at his synthetic poultry
25	Α	Antiprogenic metals? 02:56PM	25	leachate samples. I'll have to go back and see if 03:00PM
		Page 183		Page 18
1	Q	Yes, sir.	1	there were others. So he's making a comparison of a
2	À	Well, it doesn't matter. I don't know.	2	loadings bar graph where the units are basically a
3	Q	Salts, same question?	3	correlation coefficient to a chemical composition in
4	À	Yes, same answer.	4	units of milligrams per litter, and in the case of
5	Q	And bacteria? 02:57PM	5	bacteria, organisms per, I believe, it was hundreds 03:00PM
6	A	Correct.	6	milliliters or something like that. So that's what
7	Q	And I do take it you're not you don't have	7	I mean by an apples-to-oranges comparison. They're
8	-	understanding of which among potential sources	8	different units.
9		uld be the largest sources?	9	Q Different units, but do you think it's fair,
10	Α	I don't have an understanding because I 02:57PM	10	though, to compare your loadings, such as found on 03:01PM
11	have	en't seen data that would allow me to get to such	11	Figure 2-2, to what you know about the chemical
12	an u	anderstanding.	12	composition of a source that you're investigating?
13	Q	Would mass balance information allow you to	13	MR. GEORGE: Object to form.
14	have	e an understanding?	14	A I think it's not an unreasonable place to
15		MR. GEORGE: Object to form. 02:57PM	15	start, but because the units are different the 03:01PM
16	Α	It may or may not. That's not what I was	16	other thing when I look at these, and I alluded to
17	aske	ed to look at.	17	this in an earlier response, I want to see you
18	Q	Can we turn to Page 12 of your report, please?	18	were asking about what the correlation coefficient
19	Α	Okay.	19	or the height of the bar for total copper was for
20	Q	The second paragraph where it starts there 02:58PM	20	PC1, and eyeballing it, it looks on the order of .8 03:01PM
21	are,	do you see that, sir?	21	or so. So it sounds like an impressive number, but
22	Α	Yes.	22	then you go to the goodness-of-fit scatter plots
23	Q	Would you read that sentence for the Record,	23	that I showed and you see that copper has a very
24	pleas	•		poor fit for this model. So when I look at that
25	Α	There are serious flaws in the logic that led 02:58PM	25	correlation coefficient or the loading number for 03:02PM

47 (Pages 182 to 185)

Page 202			Page 204
1 Q Do you know what that means?	1	A Should I keep this open?	,
2 A My recollection it stands for high flow	2	Q I don't think you need to keep it open. Do	
3 sample.	3	you recall reading Section 6.2?	
4 MR. ELROD: Okay.	4	A Not specifically.	
5 A Or high flow station. I don't recall if I 03:33PM	5	Q Would you read the first paragraph under 6.2,	03:37PM
6 ever saw a completely satisfactory explanation of	6	please?	03.371 W
7 what an HFS base flow sample is. Okay. Continuing	7	A The overall evaluation was conducted using	
8 on, the blue crosses are USGS base flow, which I	8	multiple evaluations and investigations for multiple	
9 believe would be stream flow samples. The red	9	lines of evidence. The results of multiple	
10 crosses would be USGS high flow. 03:34PM	10	evaluations and investigations were then used to	03:37PM
11 Q Do you recall do you recall where these	11	determine overall conclusions concerning the	
12 cattle synthetic leachates plotted on the PC1 SW3	12	hypotheses. This method of evaluation is called a	
13 analysis excuse me, on the SW3 analysis?	13	weight of evidence approach. The evaluation	
14 A Which leachate?	14	conducted where the lines of evidence include the	
15 Q The cattle synthetic leachate. 03:34PM	15	following. 03:37PM	
16 A They were not in SW3. I think I if I	16	Q Okay. So is that would it be fair to	
17 didn't if I didn't, let me clarify. The leachate	17	interpret that as Dr. Olsen's setting out the weight	
18 that I saw was a preliminary PCA that did not appear	18	or lines of evidence he considered when he did his	
19 in Dr. Olsen's report, and I believe it was run	19	evaluation?	
20 sometime in mid April, so it was not SW3. 03:34PM	20	MR. GEORGE: Object to form.	03:38PM
21 Q I thought you said you compared it with some	21	A Let me read on and see what lines he cites.	
22 stream samples in your previous testimony.	22	Q Okay. Let's read the first one, the first	
23 A That preliminary analysis was a PCA that	23	A IRW geology and hydrogeology in relation to	
24 included stream samples and the synthetic leachate	24	the fate and transport of potential sources of	
25 samples. 03:35PM	25	contamination. 03:38Pl	M
Page 203			Page 205
1 Q I see. Thank you. Would you turn to Page	1	Q Okay. Did you do a similar evaluation; did	
2 A-30 of your report, sir? At the top paragraph do	2	you do an evaluation of the IRW geology or	
3 you see where it you mentioned this halfway down,	3	hydrogeology in relation to fate and transport of	
4 for an interpretation of a PCA to be viable, it must	4	MR. GEORGE: Object to the form.	
5 be consistent with other lines of evidence? 03:36PM	5	Q potential sources of contamination when you	03:38PM
6 A Yes.	6	did your evaluation?	
7 Q Do you know whether or not Dr. Olsen	7	MR. GEORGE: I'm sorry. Asked and	
8 considered other lines of evidence when he was doing	8	answered.	
9 his PCA evaluation?	9	A This goes back to the earlier questions. I	
10 A I don't know. These it did not appear that 03:36PM	10	was not asked to do this. There were other experts	03:38PM
11 he evaluated lines of evidence that I point out	11	on the team that were doing it.	_
12 following this paragraph.	12	Q So you did not	
13 Q Which was the spatial analysis?	13	A My focus was on the bullet at the bottom,	
14 A Yeah.	14	chemical and bacterial signatures, and relating that	
15 Q Did you review his report in Section 6 where 03:36PM	15	back to 03:38PM	
16 he discussed the different lines of evidence he	16	Q But there are some other you've stated that	
17 considered?	17	it's important to look at other lines of evidence in	
18 A With respect to the PCA?		doing an interpretation of PCA; correct?	
19 Q Yes.	19	A Uh-huh.	
20 A Yes, I did. My recollection is that the 03:36PM	20	Q And you did not look at the geological and	03:38PM
21 primary line of evidence for validation of the PCA	21	hydrogeological evidence when you did your PCA	
22 was the spatial analysis in terms of establishing a	22	critique; correct?	
23 poultry threshold cutoff of 1.3.	23	MR. GEORGE: Object to form.	
24 Q I hand you what's been marked as Exhibit 8 and	•	A I focused primarily on the lines of evidence	
25 that's Section 6 to Dr. Olsen's report. 03:37PM	25	within his PCA section that he said he used to	03:39PM

52 (Pages 202 to 205)

IN THE UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his) capacity as ATTORNEY GENERAL) OF THE STATE OF OKLAHOMA and) OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT,) in his capacity as the TRUSTEE FOR NATURAL RESOURCES) FOR THE STATE OF OKLAHOMA, Plaintiff,)4:05-CV-00329-TCK-SAJ VS. TYSON FOODS, INC., et al, Defendants.

VOLUME II OF THE VIDEOTAPED DEPOSITION OF GLENN JOHNSON, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 25th day of February, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

> TULSA FREELANCE REPORTERS 918-587-2878

	Pac	ge 435			Page 437
1	generally increasing in copper, but there is another	,	1	the goodness-of-fit, as far as any sample that I	149C 457
2	trend on higher numbered principal components than		2	identified within that trend analysis for the left	
3	just the first two that is necessary to explain		3	trend, I wanted to focus on samples that were at	
4	copper.		4	least that were somewhat well fit by the model. So	
5	Q Did you do that evaluation? 01:18PM	[5	on the scores plot, where I color coded the samples	01:20PM
6	A We discussed this yesterday. I looked at the		6	by the concentration of sodium plus potassium plus	01.201 141
7	scatter plots beyond two on the screen as I did my		7	chloride plus sulfate, I looked at the scatter plot	
8	PCA. I don't recall when or if copper was well fit		8	to determine the CD for potassium is .74. The	
9	by what specific number. I do recall that for at		9	closer you get to 1.0 the better fit.	
10	or and carried data, the Seatter plots 01:10	PM	10	Q Were there other dissolved solids that you did	01:21PM
11	were up around eight, nine or ten before they		11	not consider in this analysis?	
12	before they had a good fit.		12	A Could I finish my response first?	
13	Q Dr. Johnson, can't both your hypothesis of		13	Q I think I understand I thought you	
14	muddy water and Dr. Olsen's opinion that PC1 is		14	finished, but go ahead, please.	
15	associated with poultry waste both be true? 01:18	8PM	15	•	21PM
16	MR. GEORGE: Object to form.		16	Potassium is one of them. There were three others.	
17	A Only if you can dismiss all other sources of		17	Sulfate has a CD of .61. Sodium has a CD of .73,	
18	phosphorus that could be associated with particulate		18	and what was our third one? Chloride as a CD of	
19	matter, and I don't believe he's done that, and I		19	.75. So you asked what I did to evaluate. First of	
20	certainly can't dismiss them. 01:18PM		20	all, in picking those analytes, I wanted analytes	01:21PM
21 22	Q Did you try to determine what the other		21	that were well fit by the principal component	
23	sources of phosphorus were in the watershed? A I identified I know what the a list of		22	analysis.	
24	potential sources. With this analysis, I was not	:	23 24	Q I asked you which analytes you selected.	
		:19PM	25	A I thought you asked what I did to evaluate.	01.01DM
		••••••	2.5	This was step one. I apologize if you misunderstood	01:21PM
	_	re 436			Page 438
1	client. I was asked to evaluate if this principal		1	the question.	
2	components analysis supports the conclusions that		2	Q I wandered off a bit there. What do you mean	
3	were in Dr. Olsen's report.		3	by salty?	
4	Q Let me ask you a question about the salty		4	A Higher concentrations of dissolved phase	
5	waters now. 01:19PM		5	sodium, chloride, potassium and sulfate.	01: 22PM
6	A Okay.		6	Q So you didn't focus on total dissolved solids,	
8	Q Is it your opinion that Dr. Olsen's PC2 and		7	you just selected four of the dissolved ions to	
9	we're talking about the SW3 runs here.		8	evaluate?	
10	A Okay.	ΩDA.⊄	10	A That's correct, and the explanation for that	01.0003.6
11	Q indicates nothing more than association 01:19 with salty water?	7ľ IVI	10	goes back to the goodness-of-fit analysis that I	01: 22PM
12	A Again, an analogous answer to when we were		11	responded to the previous question with.	
13	saying am I saying that PC1 equals muddy water. I		12 13	Q So it's your opinion that none of the other	
14	am saying that there's a trend of samples that		14	dissolved phase ions that were detected for the PCA analysis had a goodness-of-fit, so you ignored them?	
15	· · ·	20PM	15	A I didn't ignore them. It gave me reason to	01:22PM
16	trend, and as you move up that trend, the samples	-01 141	16	put more faith in how potassium and the sodium	U1.22FIVI
17	increase in the concentration of sodium and		17	chloride and sulfate were being represented by	
18	chloride, which are analytes that prefer to be in		18	model. I didn't ignore them at all. I evaluated	
19	the dissolved phase. They're preferentially in the		19	them, and given the goodness-of-fit, those are the	
20	dissolved phase. 01:20PM		20	ones that are best fit by the model, so those are	01:22PM
21	Q And which analytes did you investigate for		21	the ones I focused on.	J 1.221 141
22	your trend analysis?		22	Q What dissolved level would you characterize	
23	A Which analytes?		23	what level of TDS, even if we only looked at those	
24	Q Yes.		24	four ions, which level of total TDS for those four	
i	A Well, again, this graph where you looked at 01:2	OPM	0.5	ions would you consider as salty?	01:23PM

39 (Pages 435 to 438)

		Page 443			Page 445
1 Q Can you explai	n to me why the patterns on		1	has a large part of the control in whatever	
	eport and Figure 3-4 of your		2	total phosphorus you find, based on this, leads me	
3 report appear to be d			3	to conclude it's related to adsorption to	
4 A I believe that th	at is because Figure 3-4 is		4	particulate matter, which is preferentially going to	
5 zoomed in on just a	ection of the total SW3 scores	01:29PM	5	be iron and aluminum. 01:	33PM
6 plot as per Olsen's Fi	gure 6.11-18C, and the Figure		6	Q So it's so it's your your belief that	
7 4-10 is the entire ran	ge shows the entire range		7	the total phosphorus is being readily adsorbed by	
•	you go to 6.11-18A of Olsen's		8	the aluminum and iron that's in the system?	
9 report, I believe he sl	lows how one of these insets		9	A I think they preferentially adsorb the	
10 is a subset of another			10	particulate matter, which will have high aluminum	01:33PM
	ay a TDS of those four dissolved	d	11	and iron. I also think there's probably there's	
	would be considered salty in		12	probably depending on environmental conditions,	
13 your view?			13	there are probably times when the adsorbed	
MR. GEORG	E: Object to form.		14	phosphorus goes into solution. I wouldn't discount	
	derstand what you told me.	01:30PM	15	1 3	:33PM
	terizes my testimony.		16	Q Then how would you account for that in your	
17 Q I wasn't trying	o do that, sir. I'm trying		17	analysis that with increasing iron and aluminum,	
18 to understand your to			18	we're having a higher degree of adsorbed phosphoru	s?
19 A Then I disagree	with what you just said. I		19	MR. GEORGE: Object to form.	
20 said within the conte	kt of this dataset, those	01:30PM	20	A I'm not sure how the statement I just made is	01:34PM
	hest potassium plus sodium plus	S	21	inconsistent with that.	
22 chloride plus sulfate.	So they are the saltiest of		22	Q Well, I think you said that well, let me	
23 this particular datase	. I doubt if those samples		23	ask another question and we'll proceed through this.	
24 are as salty as seawar	er that you might get down in		24	A Okay.	
25 the Gulf of Mexico of	r the Atlantic Ocean.	01:31PM	25	Q Do you know the value of the partition	01:34PM
		Page 444			Page 446
1 Q Do you think an	y of the ambient waters in the		1	coefficient for dissolved phosphorus in the IRW	
2 IRW are actually salty	?		2	streams?	
3 MR. GEORGE	Object to form.		3	A No, I don't.	
4 A No, not as salty	as a marine water sample, but		4	Q Would that have been important to	
5 I don't know. It's co	mpared given in that	01:31PM	5	demonstrating your analysis that's represented in	01:34PM
6 context, I would imag	ine it would still be		6	Figure 4-7?	
7 considered freshwate			7	A It would not have changed the empirical	
8 Q Did I understand	your testimony, sir,		8	observation. The total phosphorus, total iron and	
9 yesterday that you be	ieve there's an affinity for		9	total aluminum increased in samples along that	
10 phosphorus, for alum	num and iron drives the system?	01:31PM	10	trend. 01:34PM	
MR. GEORGE	Object to form.		11	Q But you will agree, will you not, that the	
12 A If you look at th	e samples along the bottom		12	partition coefficient is a method to explain what	
13 trend			13	you're demonstrating in Figure 4-7?	
14 Q Can you just say	if I even characterized that		14	A If I wanted to make a predictive model instead	
15 closely or correctly or	not and then explain?	01:32PM	15	of an instead of evaluate the results of an	01:34PM
16 A There are eleme	nts of truth in that.		16	empirical model, I would use a partition	
L7 Q Okay. Now wo	ıld you please explain?		17	coefficient, given certain other parameters, to	
l 8 A As you – as you	progress from left to right		18	predict if phosphorus would be in a dissolved phase	
19 along the bottom tren	l of Figure 4-7, you are		19	versus associated with particulate phase.	
20 increasing in concentr	ations of total iron and total	01:32PM	20	Q Can you tell me what form phosphorus is found	01:35PM
21 aluminum in the water	sample and, in addition,		21	in the IRW rivers?	
22 samples along that tre	nd are also increasing in		22	MR. GEORGE: Object to form.	
23 total phosphorus.			23	A It has been there are analyses for both	
24 Q Okay. That			24	total phosphorus and dissolved and total	
25 A So the total pho	sphorus total phosphorus is	01:32PM	25	phosphorus and dissolved phosphorus.	01:35PM

41 (Pages 443 to 446)

_		45			- 440
	Page 4	47			Page 449
$\frac{1}{2}$	Q What about for dissolved phosphorus; what form		1	about.	
3	is it in? A The two that are in SW3 are dissolved		. 4	Q Okay. Would they be negatively or positively	
4	A The two that are in SW3 are dissolved phosphorus and soluble reactive phosphorus. I think		3	charged?	
5	that's considered a soluble phosphorus as well. 01:35PM		5	A Well, the iron hydroxide, I think, would be electrically neutral because it would have both the	01:38PM
6	Q You want to look that up?		6	cation and the anion.	01:36FM
7	A I'm sorry?		7	Q What about aluminum?	
8	Q Do you want to look that up to be sure?		8	A I would think the same thing.	
9	A No.		9	Q Neutral?	
10	Q Okay. I'm going to hand you a blank page 01:35PM	1	10		01:38PM
11	marked as Exhibit 23.	-	11	if there's an anionic complex that would still have	01.001.11
12	MR. GEORGE: Can I get my page?		12	aluminum or iron associated with it that would have	
13	MR. PAGE: Do you want one?		13	a negative valence but	
14	MR. GEORGE: I'll do without.		14	Q If these are suspended particulates, would you	
15	Q Would you please write the chemical formula 01:36H	M	15		01:38PM
16	for the form of phosphorus, dissolved phosphorus		16	A I don't know.	
17	found in the IRW rivers?		17	Q Do you understand how adsorption is affected	
18	A I'm not sure I know the chemical formula for		18	by the pH in the water of the IRW?	
19	that form of phosphorus. I don't know if it's		19	A I know that pH exerts a control over which the	
20	associated with phosphate or whether it's 01:36PM		20	degree the degree to which these analytes would	01:39PM
21	three-phase.		21	be adsorbed to particulates that would be in	
22	Q Would you write both of them for us, please?		22	solution. Exactly what pH would cause a phosphate	
23	A I don't know the I don't know exactly what		23	ion to go into solution or be adsorbed, I could not	
24	it is I don't know exactly what form it is		•	tell you.	
25	associated with. 01:36PM		25	Q Wouldn't that be important for you to know in	01:39PM
	Page 4	48			Page 450
1	Q Would you write the formula for phosphates,		1	order to validate your analysis that says that	
2	sir?		2	phosphorus is being adsorbed to these particulates?	
3	A (Witness complied).		3	A I have citations that said regardless of the	
4	Q Would you put the charge on the formula,		4	pH, that they are very commonly adsorbed and with -	-
5	please? 01:36PM		5	Q Is that your understanding of chemistry, that	01:39PM
6	A I don't recall the valence of the phosphate		6	regardless of the pH of the water	
7	cat anion.		7	A No. I'm saying you misunderstood my	
8	Q Well, if it's dissolved, what would you expect		8	answer.	
9	it to be?		9	Q Okay. I'm sorry.	
10	A I would expect it to be negative. I would 01:37PM		10	A pH is important if you want to know exactly at	01:39PM
11	expect it my recollection is perhaps minus 2 but		11	what point certain phosphate phosphate ions would	
12	it might be minus 3 or minus 4. I don't recall.		12	be adsorbed rather than go into solution. My point	
13	Q Okay. Could you just kind of put indicate		13	was, looking empirically at the PCA scores plot	
1	what you think the range is for phosphate.		14	where iron and aluminum increase along that trend,	
15	A I put minus 2 to minus 3, and that's my 01:37PM		15	I'm sure that the pH in individual samples is	01:39PM
I	recollection.		16	important in determining whether it's going to be	
17	Q Fair enough, and can you tell me what are the		17	adsorbed into solution, but even without that	
18	suspended particles that adsorb the P?		18	knowledge, I can look at that graph and come to the	
19	A The reference that I cite indicates aluminum,)) <i>(</i>	19	conclusion that the total phosphorus increases in	01.4003.5
20	manganese, hydroxides. The degree to which they are 01:371	'M	20	samples that also have higher concentrations of	01: 40PM
21	also adsorbed by clay particles. I don't know.		21	total iron and total aluminum. So in no way was I	
22	Q Do you also believe it's iron oxides also		22	saying that pH is immaterial.	
23	given your analysis of the high association of		23	Q If pH was between 7.3 and 7.8, would the	
l .	A I said iron hydroxides. The degree to which		24	surface charge of the aluminum silicates, iron	01.4003.4
125	they're oxides versus hydroxides, I'm not sure 01:38PM		25	oxides and clays be all negatively charged?	01:40PM

42 (Pages 447 to 450)

	Page 451		Page 453
1	MR. GEORGE: Object to form.	1	to evaluate relationships between dissolved and
2	A I don't know.	2	total phosphorus and the presence of TSS in the
3	Q Is it your understanding, sir, that negatively	3	samples?
4	charged constituents or species repel each other?	4	A I did not go back to the Access database at
5	A Yes. 01:41PM	5	all. My starting point for this analyses were the 01:44PM
6	Q So if both the phosphorus is negatively	6	Excel spreadsheets, the subdatabases, et cetera.
7	charged and the particulates are negatively charged,	7	Q Did you make from any database did you make
8	adsorption would not occur; is that correct?	8	an evaluation of any type?
9	A I have a feeling it's a bit more complicated	9	A The evaluation again was total versus would
10	than that. Are you telling me that I know that 01:41PM	10	you read the question back? 01:45PM
11	phosphorus will adsorb to clay particles. So I	11	(Whereupon, the court reporter read
12	think there's probably a bit more to it than that	12	back the previous question at Page 452, Line 25 to
13	characterization.	13	Page 453, Line 3.)
14	Q Well, if the phosphorus is in a dissolved	14	A Well, I did bring TSS in from one of the Excel
15	phase and it's negatively charged and the 01:41PM	15	databases and plotted one of my graphs of the PC 01:45PM
16	particulates are also negatively charged, would you	16	scores plot as a function with a symbol color
17	expect adsorption to occur?	17	being related to TSS, and those the TSS data that
18	MS. COLLINS: Object to form.	18	were available showed a similar pattern to the total
19	A I don't know. I've not approached this from a	19	iron plus total aluminum, so that gave me I'll
20	kinetics standpoint. There are others on our team 01:41PM	20	get to your you asked me if I evaluated TSS. The 01:45PM
21	that did. Again, I'm making the empirical	21	answer is yes.
22	observation on a principal scores plot that	22	Q Well, in relationship to
23	phosphorus in total phosphorus as reported by the	23	A If you'd like a shorter answer.
24	lab is present in samples in higher concentrations	24	Q dissolved phosphorus and total
25		25	phosphorus 01:45PM
:	Page 452		Page 454
1	total aluminum.	1	A Total, yes.
2	Q I think I'm quoting you, Dr. Johnson, in	2	Q concentrations?
3	effect that other lines of evidence are always	3	A Total, yes.
4	important to consider in order to validate your	4	Q You didn't look at the dissolved phase in the
5	conclusions for PCA; is that not correct? 01:42PM	5	same sample? 01:45PM
6	MR. GEORGE: Object to form.	6	A Well, I focused on total because the total
/	A It is important to consider other lines of	7	phosphorus increases as total iron and total
8	evidence. Are you representing to me that	8	aluminum increases. I followed that observation up
9	adsorption of phosphate does not occur onto iron and	9	by plotting the PC scores over top with symbols
10	aluminum particles? 01:42PM	10	related to total suspended solids. 01:46PM
11	Q I think, Dr. Johnson, I'm representing to you	11	Q Wouldn't it be important to understand the
12	that you should probably take a close look at this.	12	dissolved phosphorus component in order to measure
13	MR. GEORGE: So that means, no, he's not	13	the adsorption process that you are proposing for
14	representing that to you. Q Would you agree that there is a 01:43PM	14 15	PC1? MR. GEORGE: Object to form. 01:46PM
15	• •	16	
16 17	relationship let me say it this way: Would you agree that if both the particles and the phosphorus	17	A If I was trying to kinetically model, that might be something I want to take into account. I
18	were negatively charged, there's less opportunity	18	was trying to establish that the empirical
19	for adsorption?	19	observation I was making on those scores plot was
20	A Yes. If that's true, I would expect, yes. 01:43PM	20	backed up by a set of data that wasn't even brought 01:46PM
21	Q And that if one of the constituents was	21	into the PCA, which was the total suspended solids
22	negative and the other one was positive, there would	22	data.
23	be an affinity for adsorption; is that correct?	23	Q But if you were really trying to understand
2,7		24	whether or not particulates or this iron and
24	A I think that's the that's accurate.		

43 (Pages 451 to 454)

		ş	
1	fact driving PC1, wouldn't it be important to also	1	Q Okay. What is the total dissolved solids?
2	know whether or not they're having an impact on	2	A 405.25.
3	dissolved phase constituents in the same samples?	3	Q And total suspended solids are what level?
4	A I could look at that data to determine if it	4	A 267.984.
5	was consistent, but I would but I had literature 01:47PM	5	Q With regard to the total suspended solids, 01:49PM
6	and I had data that was not included in the PCA that	6	would you characterize those as being the I'm
7	were supportive of my conclusion that total	7	going to use it loosely but the muddy
8	phosphorus was a function of iron, aluminum and	8	characterization?
9	total suspended solids. You're asking are there	9	A Yes, using that term loosely.
10	other things that I could have looked at to see if 01:47PM	10	Q You would say
11	that was also consistent with that, yes, there	11	A The higher total suspended solids implies
12	probably were, and this may well be one of them, but	12	higher turbidity, which would be characterized as
13	I did not do that part of it if that's what you're	13	muddier.
14	asking.	14	Q And would you be able to tell if this water
15	Q That was my question to you, sir. 01:47PM	15	would this water appear muddy or clear at 267.984 01:50PM
16	A Okay.	16	TSS?
17	Q Do you recall reviewing Appendix C of Dr.	17	A I don't know visually how that number would
18	Olsen's report, and what I'm going to do is give you	18	compare. I don't know how that number would compare
19	a copy of that and ask you to look at it.	19	to a visual observation of the sample.
20	A I did look at this appendix. 01:48PM	20	Q You haven't taken samples before where you 01:50PM
21		21	noticed the TSS and then observed whether the water
1	Q Would you turn to Page 2, please, sir?	22	appeared to be cloudy or clear?
22	A Uh-huh.	23	
23	Q I don't know if I highlighted those. Yes, I	24	A I probably have at some point in my career. I don't remember where the number 267 would have
24	did. Could you tell me what the levels first of	1	
25	all, tell me what sampling group this is on Page 2 01:48PM	25	
<u> </u>	455		457
	64151116	1	O Olian What about in your total dissalved
1	of this exhibit.	2	Q Okay. What about in your total dissolved solids; would that be within the area of salty in
2	A The title is Summary of Edge of Field Poultry	3	
3	Samples.	}	your analysis?
4	Q Okay. Do you recall that there were a summary		A Wall sains healt to also The ten hin for
	6.1. 1. 6.7.1. 1. 1. 1. 1. 1. C. 04.4073.5	4	A Well, going back to okay. The top bin for
5	of the edge of field poultry samples in Appendix C 01:48PM	5	total sodium plus potassium plus chloride plus 01:51PM
6	of Dr. Olsen's report?	5	total sodium plus potassium plus chloride plus 01:51PM sulfate well, that's there's more to total
6 7	of Dr. Olsen's report? A I recall it now that I look at it.	5 6 7	total sodium plus potassium plus chloride plus 01:51PM sulfate well, that's there's more to total dissolved solids than just those four, but those on
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6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	of Dr. Olsen's report? A I recall it now that I look at it. Q Okay. MR. GEORGE: David, is it your representation that Exhibit 24 is an exact copy of 01:49PM what was exhibit I'm sorry, Appendix C to Dr. Olsen's report? MR. PAGE: Yes. MR. GEORGE: Okay. What threw me was the header at the top that says draft, do not produce. 01:49PM I don't recall seeing that on his report but maybe it was. MR. PAGE: I don't recall either. My understanding, this is a copy of exactly what's in Appendix C of his report, Table 1. 01:49PM Q Would you look at the total suspended and total dissolved solids, sir, under average?	5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22	total sodium plus potassium plus chloride plus sulfate well, that's there's more to total dissolved solids than just those four, but those on their own, the top bin of this graph is greater than 300 milligrams per liter. So this 405, to the extent that total dissolved solids can be taken total dissolved solid, this looks to be on the high end of the range. Q Okay. Can I ask you, sir, to look at the total P using method 4500 and using total dissolved total P using 4500, and could you give me those two averages, please? A You want me to average the two values? Q Well, I think the average values are provided for you there. Other total dissolved P by 4500 PF is 4.8239. Total phosphorus by 4500 PF is 8.1395.
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		Page 467			Da 460
		Page 467			Page 469
1	A I know that there were locations where I could		1	around the 11.2712. I'd be curious to see a	
2	see the bottom of the stream.		2	histogram that shows the full distribution of total	
3	Q In that locations that you could not, was it		3	suspended solids to see how representative that	
4	because the water had kind of a greenish hue to it?	00.0001.6	4	11.27 is.	
5	MR. GEORGE: Object to form.	02:23PM	5		02:25PM
7	A At Lake Tenkiller I remember I could see the		6	solids excuse me total dissolved phosphorus in	
8	bottom near the shore, and I couldn't see the bottom		7	an Illinois River stream is low at .2932 parts per	
9	obviously when it got deeper. I don't know if that's because of a greenish hue or because the		8	million?	
10	depth of the water. 02:23P	A.1	9	A I don't know what number I would put on low	00.0673.4
11	Q Would you read for the Record the dissolved P	1V1	10 11	versus not low. The .2 what number did you say?	02:26PM
12	method 4500 and the total phosphorus at the 4500?		12	Q I'm just reading the average here as .2932. I	
13	A You mean the average concentrations for those		13	thought I heard you say that you characterized these phosphorus levels as low.	
ı	two?		14	- ·	
15	Q Yes, sir. I'm just going to focus on average	02:23PM	15		02:26PM
16	concentration for this line of questions.	∪J1 1VI	:		02.201 IVI
17	A Total dissolved P by 4500 PF, 0.2932. Total P		17	A Yes, yes.	
18	by 4500 PF, 0.3117.		18	Q And edge of field was 8.4.	
19	Q Would you estimate that the fraction of		19	A I forget what number is the is considered,	
20	dissolved P would be greater than 90 percent in	02:23PM	20	and I don't know even know they use this term, an	02:26PM
21	these samples?		21	action level, so I'm not sure where the .2932 fits	02.2011(1
22	A Around 90 looks to be a reasonable estimate.		22	in that scale.	
23	Q Wouldn't that tend to negate your hypothesis		23	Q Do you know what the action level is for	
24	that there's an affinity of phosphorus for total		24	phosphorus in the IRW according to Oklahoma law?	
25		2:24PM	25	MR. GEORGE: Object to form.	02:27PM
		Page 468			Page 470
1	MR. GEORGE: Object to form.	_	1	A No, I don't.	,
2	A You previously this means that, if I'm		2	Q Would it surprise you to know it was .037?	
3	reading this data correctly, the majority of the		3	MR. GEORGE: David, are you representing	
4	phosphorus in these samples is total dissolved.		4	that's an action level?	3
5	Q Yes. 02:24PM		5	MR. PAGE: Well, I'm just using his	02:27PM
6	A And we have total suspended solids, which is		6	terminology.	02.271 101
7	on the low end. So I think this would be consistent		7	MR. GEORGE: Well, are you you said di	d
8	with what I concluded in the samples to the left		8	you know the action level is.	-
9	side of this graph tend to have lower total		9	A And I prefaced action level saying I don't	
10	phosphate and I'm not sure I understand the	02:24PM	10	know if this is an accurate term.	02:27PM
11	question.		11	Q Well, do you mean by like a phosphorus	
12	Q Well, doesn't this indicate, sir, that there			criteria?	
13	isn't a lot of adsorption going on in small		13	A Yeah.	
14	tributaries during high flow conditions?		14	Q Okay. Yes, I'm representing that 0.37 is the	
15		02:25PM	15	phosphorus criteria for scenic rivers in the	02:27PM
16	A We have both low total phosphate and we have			Illinois River watershed.	
17	relatively low total suspended solids. So for		17	A Yes, that would be above that. The .2392	
18	samples within that range of total suspended solids,		18	would be above that level.	
19	I would agree with that.		19	Q Well above it; correct?	
20	Q And the sample type, which would be small	02:25PM	20	A Yes.	
	tributary types high flow conditions?		21	Q So in that context, it wouldn't be a low level	
22	A To the extent that these averages of over a		22	of phosphorus, would it?	
23	hundred are representative of the dataset as a			A You are correct.	
	whole. I would imagine that this is not a uniform		24	Q Can we turn a couple more pages to Page 8, a	
25	that these means are not narrowly calculated	02:25PM	25	does it not say at the top that these are the group	02:27PM

47 (Pages 467 to 470)